



Contribution ID: 78

Type: Poster

## Synthesis, structure and properties of synthetic trogerite (UO<sub>2</sub>)<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>·12H<sub>2</sub>O

Monday, 19 April 2010 11:45 (20 minutes)

Synthetic trogerite (UO<sub>2</sub>)<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>·12H<sub>2</sub>O (henceforth only ST) can be obtained by direct mixing of uranyl nitrate and arsenic acid solutions in equivalent ratio 3:2. In this case the following competitive reactions become possible:

UO<sub>2</sub>(NO<sub>3</sub>)<sub>2</sub> + H<sub>3</sub>AsO<sub>4</sub> + 4H<sub>2</sub>O → HAsUO<sub>6</sub>·4H<sub>2</sub>O(s) + 2HNO<sub>3</sub> (uranoarsenic acid formation)

3UO<sub>2</sub>(NO<sub>3</sub>)<sub>2</sub> + 2H<sub>3</sub>AsO<sub>4</sub> + 12H<sub>2</sub>O → (UO<sub>2</sub>)<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>·12H<sub>2</sub>O(s) + 6HNO<sub>3</sub> (synthetic trogerite formation)

The acidity increase results in uranoarsenic acid formation while its decrease essentially enhances a contribution of triuranyl diarsenate hydrates formation. The reaction temperature is also an important factor. The partial dehydrated ST and the intermediate crystallohydrates mixture are formed in the case of the synthesis temperature increase. For the reasons described above synthetic trogerite has not so far been obtained in the form of an individual crystal compound, free of any impurity phases. Its X-ray data and crystallographic characteristics are unknown. In this work the ST synthesis technique is proposed. Its dehydration and thermolysis were investigated. Structure and properties of synthetic trogerite were studied by X-radiography, IR-spectroscopy, X-ray fluorescence analysis, and scanning calorimetry. Our research has shown that dehydration is the only temperature caused transformations in the range of 20-800°C. In the interval 50-200°C trogerite loses eight molecules of water and transforms into well known (UO<sub>2</sub>)<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>·4H<sub>2</sub>O.

The both crystallohydrates with crystal lattices built of coordination polyhedrals belong to many-membered family of the uranium (VI) compounds having the layered structural type. Layers are formed by pentagonal bipyramids UO<sub>7</sub>, connected by the general edge to produce continuous chains and combined by tetrahedrons AsO<sub>4</sub><sup>3-</sup>. Opposite layers of tetrahydrate are strongly connected by the covalent bonds, forming chains (O<sub>3</sub>)As-O-U(O<sub>5</sub>)-O-As(O<sub>3</sub>). The length of such chains determined the interlayer distances that is equal 8.782. It is not enough long chain for similar bonding of opposite layers located on 11.079 in UO<sub>2</sub>(AsUO<sub>6</sub>)<sub>2</sub>·12H<sub>2</sub>O. Therefore bonding of layers in trogerite is not rigid and occurs as the system of H-bonds, formed by H<sub>2</sub>O molecules making a coordination environment of interlayer atoms of uranium (VI). Three H<sub>2</sub>O molecules in UO<sub>2</sub>(AsUO<sub>6</sub>)<sub>2</sub>·4H<sub>2</sub>O exhaust coordination possibilities interlayer atoms of U(VI) in its pentagonal bipyramid. Three H<sub>2</sub>O molecules in UO<sub>2</sub>(AsUO<sub>6</sub>)<sub>2</sub>·4H<sub>2</sub>O exhaust coordination possibilities interlayer atoms of U(VI) in its pentagonal bipyramid. Fourth H<sub>2</sub>O molecule is located in zeolite similar cavities, isolated and p

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**Session Classification:** Poster Session - Chemistry of Actinide and Trans-actinide Elements

**Track Classification:** Chemistry of Actinide and Trans-actinide Elements